AMSAT SATELLITE REPORT

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STOP PRESS:
ISKRA 2 transponder is on. Frequencies are as discussed elsewhere in this issue. Passband inverted.

ISKRA 2: Out the Door; Trips, Stumbles and Falls

The newest Amateur Radio spacecraft ISKRA 2 had a unique birth for an amateur bird. Its situation and ultimate demise are reminiscent of UoSAT, however. In fact, ISKRA 2 seems to be about to outdo UoSAT in a negative sense. Whereas UoSAT got into trouble during the test phase when a computer glitch simultaneously activated the 2 meter and 70 cm transmitters, ISKRA 2 has yet to place its transponder on the air because of the same type of desensing problem which is haunting UoSAT. Furthermore, while UoSAT has expended perhaps a fifth of its anticipated 3 year lifetime so far, ISKRA 2 will last no more than a few weeks, perhaps 6, until the inevitable fall through the atmosphere occurs. Thus ISKRA 2 will be a short-lived bird with roughly the life expectancy of OSCAR 1 (launched 12 Dec. 61, decayed 31 Jan. 62). ISKRA means spark. Apparently the name is curiously prophetic!

In the article that follows we will examine various aspects of ISKRA 2 as we now understand them. Most of the information originates with official Russian sources and is relayed by usually reliable sources. However, we caution that no direct contact with the launch authorities has been established and *ASR* has no documentary proof of the specifications given. Some of the assertions made are easily verified by independent analysis, however.

Background:

The Salyut 7 space station was launched into low earth orbit on 19 Apr. 82. No Cosmonauts were aboard at the time. However, on 13 May a two man crew consisting of Lt. Col. Anatoliy Berezovoy and Cosmonaut Valentin Lebedev were launched aboard Soyuz T-5. This was Lebedev's second space mission and Berezovoy's first flight into space. On Friday, 14 May at 12:36 UTC the Soyuz had successfully docked with the Salyut 7. The crew spent the weekend reactivating the Salyut space station. On Monday, 17 May at 11:07 UTC, according to *TASS*, the Soviet news agency, "a small artificial earth satellite ISKRA 2 was separated . . . from the spacecraft . . . and put in orbit." The Cosmonauts "prepared the sputnik for launching, checked the functioning of its systems and at the proper time put the sputnik into open space through the air lock chamber." The event was seen on TV in several Eastern Bloc nations including the USSR. Amateurs in other countries who saw the spacecraft on TV provided parts of the description of the appearance of ISKRA 2 given below.

Systems:

According to *TASS* and other sources, ISKRA 2 includes "a retransmitter [transponder] for experiments in amateur radio communication, a memory device [codestore or bulletin board], command radio channel, a radio telemetric system [telemetry encoder] for relaying scientific and technological information and data about the functioning of the equipment." ISKRA 2 was built by students at the Moscow Aviation Institute with "the participation of young scientists and radio enthusiasts" according to *TASS*.

A malfunction apparently associated with the command decoder, as mentioned above, has precluded exercising the transponder and the codestore features for the present. The transponder pass band is 21.230-21.270 MHz uplink and 29.580-29.620 MHz downlink. The beacon is located at 29.578 MHz plus or minus Doppler shift (about 0.5 kHz here). Recommended uplink power is 200 watts ERP. Though not stated, since it is widely assumed the satellite receive antenna is linear, if you can obtain circular polarization on the uplink, you likely will realize an advantage. A 15 meter turnstile might be the answer. It would seem prudent, however, to await the activation of the transponder before casting about in the aluminum tubing pile for some suitable materials! The transponder output power is given as 1 watt. The beacon can be operated at 300 mW or 1 watt selectable by ground command. It is not stated where (in the band) the codestore output will appear but if the other RS birds are indicative, the ISKRA 2 codestore will appear at 29.578 or perhaps 29.622 MHz. The codestore is reported to have a 256 Morse character memory. The telemetry is organized into 6 subframes per frame as shown in the tables below. The cw code speed is about 20 wpm. The high speed telemetry (hst) of subframe 6 is 300 or 400 baud. The character set of the hst is unknown at the present.

Physical Characteristics:

The ISKRA 2 is said to strongly resemble AMSAT-OSCAR 7 in several regards. Like AO-7, ISKRA uses a

cylinder with a hexagonal cross-section (six-sides). Each of the 6 faces is covered with solar cells. The spacecraft is between 50 and 60 cm (20 to 24 inches) tall and 30 to 40 cm (12 to 16 inches) across. The entire package weighs 28 kg (62 lbs). Unlike several of the RS birds of the recent vintage, the frame of ISKRA 2 is not pressurized. The components are open to the cold of space.

Orbital Characteristics:

The orbit is similar to other Salyut missions and also similar to the Space Shuttle orbits. The orbital height as of 24 May was 328 km (204 miles). The period was 91.097 minutes; increment 23.164 degrees; inclination 51.6 degrees. In other words, on the ascending node, ISKRA 2 travels from southwest to northeast. Because of its low altitude, ISKRA 2 is losing altitude rapidly; about 1 km per day (.6 mile per day). Soon it will enter the denser regions of the atmosphere and lose altitude even more rapidly. The rate of descent will increase exponentially until the satellite deorbits probably in June or perhaps July 82. The ground track for ISKRA 2 was given in *ASR* #33. For range circles you might care to construct a set of circles based on your OSCAR 8 range circles. Since AO-8 is at about 900 km and ISKRA 2 is at about 328, the range circles for ISKRA 2 will be 328/900 or 36% as large as those for AO-8 for a given elevation angle. Maximum visibility time of ISKRA will, expectedly, be 36% of AO-8 or just under 6 minutes from horizon to horizon.

Because of the significant difficulty in tracking an object with an orbit as dynamic as ISKRA's, the best bet for accurate tracking information is your AMSAT Nets.

The placement of an HF transmitter in the F2 layer should provide for some interesting propagation. Too bad ISKRA 2 won't be around long enough for experience levels to rise. And, the launch of ISKRA 2 in a "Get Away Special" mode anticipated AMSAT plans to work with NASA Astronauts as described briefly in *ASR* recently.

ASR gratefuly acknowledges the assistance of the following individuals in compiling this story about ISKRA 2: K1HTV, PAØDLO, G3IOR, WØCA, W6CG, WD4AHZ.

ISKRA 2 Telemetry Tables

Frame begins with identifier: RKØ2
General Form of each channel: xyn where x is I, N, A, M for first 4 subframes and is absent for #5; n is a two digit number.

Ch. Desg.	Parameter	Equation	Typical Value
1st Subframe			
IR	transponder output power in milliwatts	P=10*n	05
ID	voltage on logic block in volts	V=.1*n	90
IG	voltage on receiver in volts	V=.1*n	90
IU	voltage on transmitter in volts	V=.1*n	90
IW	voltage on logic #2 in volts	V=.1*n	50
IK	service channel	?	63
IO	service channel	?	00
2nd Subframe			
NR	transponder output power in milliwatts	P=10*n	05
ND	heat sink structure temp in deg C	T=2*n−100	62
NG	heat sink guide structure temp, deg C	T=2*n−100	40
NU	radiator plate #1 (inside) temp, deg C	T=2*n−100	35
NW	radiator plate #2 (outside) temp, deg C	T=2*n−100	35
NK	digital logic block #1 temp in deg C	T=2*n−100	62
NO	digital logic block #2 temp in deg C	T=2*n−100	60
3rd Subframe			
AR	transponder output power in milliwatts	P=10*n	05
AD	confirmation of command link	?	64
AG	service channel	?	02
AU	reference spacecraft temp in deg C	T=2*n−100	77
AW	not used		00
AK	not used		00
AO	not used		00
4th Subframe (In sunlight)			
MR	transpnder output power in milliwatts	P=10*n	05
MD	solar panel #1 voltage in volts	V=.2*n	09
MG	solar panel #2 voltage in volts	V=.2*n	89
MU	solar panel #3 voltage in volts	V=.2*n	89
MW	solar panel #4 voltage in volts	V=.2*n	90
MK	solar panel #5 voltage in volts	V=.2*n	90
MO	solar panel #6 voltage in volts	V=.2*n	89
5th Subframe			
R	transponder output power in milliwatts	P=10*n	05
D	beacon output power in milliwatts	P=10*n	04
G	voltage of battery in volts	V=.2*n	86
U	temperature of satellite main frame, deg C	T=2*n−100	61
W	temperature of 10 meter output stage, deg C	T=2*n−100	59
K	AGC of command receiver ?	?	54
O	AGC of transponder receiver ?	?	00
6th Subframe			

Subframe #6 comprises several hundred characters of high speed telemetry.

German Arrivals Portend Spacecraft Completion

The arrival on Thursday, May 20 of the AMSAT DL team signaled that the final stages of spacecraft construction are at hand. The three man crew comprises AMSAT DL President Dr. Karl Meinzer, DJ4ZC, Ulrich Muller, DK4VW and Wilford Gladisch. Karl is pictured most recently in *ASR* #30 while Ulrich and Wilford appear on the cover of *ORBIT* #8. Ulrich has done much of the engineering on the Phase IIIB transponders and personally built and tested many of the circuits. Wilford is responsible for the exquisite drawings originating in AMSAT DL including the drawing of ESA's Ariane rocket which adorns the Project OSCAR Calandar as well as W3IWI's report to the members. The report was included in the *ORBIT* #9 mailing earlier this year.

Arriving at Washington National Airport Thursday evening from Boston's Logan Airport, the DL crew brought with them the primary instruments that will help alter manifestly the entire course of Amateur Radio: the Mode B and the L-transponder which will fly on Phase IIIB next January. By Sunday most of the sub-system boxes had been bolted in place and the spacecraft was being prepared for a full power-up test with all modules

in place. This would include the IHU (Integrated Housekeeping Unit), BCR (Battery Charge Regulator), SEU (Sensor Electronics Unit), LIU (Liquid Ignition Unit), Sun and Earth Sensors, as well as the batteries, fuel tank, torquing magnets, nutation dampers, antennas, and transponders. Following the power-up tests the spacecraft will be prepared for the thermal vacuum test to be performed at the Goddard Space Flight Center close to where the spacecraft is now being assembled. The AMSAT Spacecraft Laboratory is located at the Goddard Space Flight Center in a building provided by NASA for the explicit purpose of allowing the public visual access to the spacecraft assembly process. It is a very exciting portion of the program when a spacecraft is nearing completion.

Indicators from the Lab were all positive at the time of this report and no major problems were anticipated according to project spokesman. *ASR* will continue its series entitled Phase III Countdown in the near future. *ORBIT* magazine will feature photos of the spacecraft as it reaches completion.

Mystery Antenna Array Analysis: Backfire

A visual analysis of the photograph appearing on the cover of the Russian magazine, *RADIO*, for January 82 has revealed that the antenna likely is a 2 meter backfire array. The cover photograph was reproduced in *ASR* #28 for March 8, 1982 and appeared later in *ORBIT* magazine #10. Many have since correctly identified the array as a backfire antenna. Dr. Al Katz, K2UYH, says the real clue was the so-called shroud around the periphery which is often the hallmark of this type of array. NØUU, Larry Stoskopf, also correctly identified the array. Larry won a "Coke bet" at Dayton by so doing. . . but failed to collect from your Editor. . . both forgot!

If you didn't recognize this exotic breed you certainly weren't alone. Your Editor is your colleague in this benign ignorance. The rarely used backfire features a rearward-looking array with what appear to be 3 or 4 elements in each of 2 planes presumably powered and phased to yield circular polarization. The spacing of the driven elements from the reflective screen is engineered so that the wave front reflected is in phase with and reinforces the wave from the driven elements traveling away from the reflector. We leave it to the not-too-timid to estimate the effective area, gain and other characteristics of this 2 meter array.

Juggler Photo ID Revealed

In *ASR* #33 was pictured a juggler. We suggested that the Editor's job is rather like that juggler. In this issue we would like to credit the photo and explain what is really going on. The photo came from Larry Kozil, K8MU, of Plymouth, Michigan. Larry's other hobby is juggling and the photo came from the 1980 International Jugglers' Association Convention in Fargo, North Dakota. Thanks to Larry for submitting the photo which depicts the challenges of Editorship better than I could hope to do in the grist of this mill: words!

WH6AMX "DX"Pedition Nets Five States

Now it's Rick's turn. After watching much of the DX fun stateside go to fellow Hawaiian KH6IBA, WH6AMX decided to travel to a cottage on the east side of a mountain range. The mountains had precluded his working the low-elevation passes which were visible in the Eastern States. So from 12 through 16 April Rick set up a station as shown in the accompanying photos. Standing next to the Cushcraft crossed yagi is Rick. A 10 meter sloper is attached to the mast. Power line noise caused some problems for a couple of passes. The other photo shows the obstacle Rick sees from the West looking eastward. Those mountains are 850 meters (2800 feet) tall! When the line noise at the cottage allowed, Rick was able to work K1LJL (Vermont); W1NU (Connecticut); WA1ZUB (Massachusetts); K3SL (Delaware) and K1DS (Rhode Island). Quite a nice catch. On the next trip to the cottage Rick will be gunning for Maine and New Hampshire. The noise wiped out those skeds on the last occasion. Nice work, Rick!

AMSAT To Engineer U.N. Station

AMSAT has been requested to assist in the establishment of a Mode J station at the United Nations Secretarial building in New York City. Mr. Ormond Abbott, KC2MA, of the United Nations Radio Club requested the assistance through AMSAT Executive Vice President WA2LQQ. WA2LQQ had recently made a presentation to the Metroplex Amateur Communications Association, the largest Amateur Radio Club in the United States. KC2MA was inspired to begin an upgrade of the station at the U.N. building which has previously operated Mode A under the callsign 4U1UN. A number of operators from the New York City area have helped get the 4U1UN call on the satellites. Notable among the crew are W2TO, Hans, W2RS, Ray and N2KW, Allan.

Now Ormond wants to place 4U1UN on Mode J. The needs of the U.N. Radio Club are basically for systems engineering, software and training. W2RS has been appointed Project Officer for this endeavor and will coordinate AMSAT's response to the U.N. Radio Club. Ray will recommend a sound technical approach to the sticky problems of installing a viable Mode J station on the 40th floor of the 42 story U.N. building. The problems of access to the building especially the roof area are major logistics considerations which need be dealt with at the outset. Antennas and transmission lines will need close attention. The RF environment of New York City is among the most active in the world and the chances for EMC/EMI problems are enormous. The ARRL has been enlisted to assist in the area of software. The ARRL will be supplying OSCAR Locator Packages for U.N. Radio Club Members' use. If the station antennas are to be computer controlled, AMSAT Software Exchange will likely supply the software to program the computers. The final aspect of training is yet to be addressed but WA2LQQ has suggested to KC2MA that a short seminar for the Club members would be all that is necessary to get the majority of the members proficient in Mode J operations.

No specific deadline for completion has been set by the Club or by AMSAT for completion and activation of the 4U1UN Mode J station but a "talking" date of the Autumn seems appropriate according to KC2MA, W2RS and WA2LQQ. Will a new country appear on Mode J? We hope so! How many will that make for you?

RA9MBN, G3IOR Contest Winners

Recently heard on RS-5 Bulletin Board (Codestore): "Congrats RA9MBN G3IOR won orbital measurements contest and *Radio* magazine prizes." The contest referred to was one held some months ago which challenged participants to measure the period of an RS satellite as accurately as possible.

ASE CBBS 5X9

Decoded: The AMSAT Software Exchange Computer Bulletin Board System is running loud and clear. System operator N5AHD reports the first few weeks of operations have seen upwards of 20 users generate nearly 100 messages. A few minor bugs have been dismissed and all seems to be running smoothly according to Bob. Other refinements are on the way, he advises. A few additional points should be kept in mind Bob says.

1. The system will likely be available evenings and weekends. The times of operation published are the minimum available times only. In general, anytime the system is not needed by Bob for other purposes it will be on-line for the CBBS.

2. In case you experience difficulty and are unable to access the system to describe the malfunction, you are invited to write Bob or call him at the address or phone number given below.

3. Orbital data is most often updated on Thursdays or Fridays.

4. In the future the transmission time will be reduced by eliminating the usual sign-on menu. Instead use a) ? command to obtain the brief list of valid commands or b) F command and choose the INSTR file for complete instructions.

The system operator may be reached at: Robert J. Diersing, N5AHD, 4129 Montego, Corpus Christi, TX 78411. Telephones (voice) are 512-852-3196 (home) or 512-991-6810, ext 289 (office). The CBBS telephone number is 512-852-8194. We typoed the latter in *ASR* #31. Sri. Any Bell 103-compatible modem will work well with the ASE CBBS.

AMSAT Officers In Signal

Two AMSAT Officers have had articles appear in the May/June issue of *Signal*, the journal of the Armed Forces Communications-Electronics Association (AFCEA).

AMSAT Treasurer Dr. Roy Rosner, K4YV, has produced an article entitled, "Packet Switching for Fast, Reliable Defense Networks" which appears in the current *Signal*. Roy is Director of Advanced Planning for the General Services Administration's Automated Data and Telecommunications Service. His recent book, "Packet Switching: Tomorrow's Communications Today" is published by Lifetime Learning Publications, Belmont, CA 94002.

AMSAT Executive Vice President, WA2LQQ, Vern "Rip" Riportella's article appeared in the "Ham Radio & MARS News" feature of the same issue of *Signal*. The regular column written by Dr. Ted Cohen, N4XX was devoted largely to the AMSAT-OSCAR program.

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